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10/532,907	04/27/2005	Nathan T Hayes	33072/101/101	2027

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EXAMINER	
NGUYEN, KIMBINH T	
ART UNIT	**PAPER NUMBER**
2628	

DATE MAILED: 11/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/532,907	Applicant(s) HAYES ET AL.	
	Examiner Kimbinh T. Nguyen	Art Unit 2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17,19-28,30-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *31* is/are allowed.

6)☒ Claim(s) *1-17,19-28,30 and 32-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-17, 19-28, 30-50 are pending in the application.

Claim Objections

2. Claim 32 is objected to because of the following informalities: typing error: "hierarchal interval". Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ashton (5,596,685) I view of Snyder "Interval analysis For Computer Graphics", ACM 1992, pages 121-130.

Claims 1-6, Ashton teaches in a photorealistic image synthesis method (3D image synthesis pipeline) wherein stored digital representations of physical 3D object scenes are selectively input (3D data base; fig.1), and one or more user-defined shading routines are selectively called upon in the course of assessment of the stored digital representations of physical 3D scenes in furtherance of the production of a rectangular output array of pixels representing the visible set of surfaces of each of the stored digital representations of physical 3D scenes (col. 4, lines 17-39), Ashton does

not teach interval analysis; however, Snyder teaches executing an interval branch-and-bound method to compute shading values for pixels (computing points on the implicit curve, see section 4.1, page 127), to a user specified certainty, of the rectangular output array of pixels representing the visible set of surfaces of each of the stored digital representations of physical 3D scenes by successively splitting each object of the objects of the physical 3D object scenes (subdividing the region x into subregions, called proximate intervals; section 4.1), each object having a surface delimited by a non linear function (nonlinear equations; see abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the interval analysis taught by Snyder into the ray tracing method of Ashton, because interval analysis can be used to solve a wide variety of problems in computer graphics which include ray tracing, interference detection, polygonal decomposition of parametric surfaces, and CSG on solid bounded by parametric surfaces (see abstract). Further, Snyder discloses non linear function is parametric (nonlinear system of equations; see section; an interval analysis is performed over a parametric domain of each object of the objects of the physical object scenes (parametric surfaces), see sections 1 and 1.1; unknown parametric variables of the non-linear functions are ascertained using interval analysis (see section 1); consistency is evaluated against a domain of a screen coordinate system (section 1.2, "Interference Detection").

5. Claims 7-17, 19-28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ashton (5,596,685) I view of Snyder "Interval analysis For Computer

Graphics", ACM 1992, pages 121-130 and further in view of Enger "Interval Ray Tracing – a divide and conquer strategy for realistic computer graphics", 1992, pages 91-103.

Claims 7 and 8, Enger discloses a solution set for the parametric variables is input to the one or more user-defined shading routines; an assessment of consistency against the screen coordinate system includes information of boxes representing select areas within the local coordinate system into the coordinate system of the screen (see section "Remarks", pages 99-100). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the shading routine taught by Enger into the ray tracing method of Ashton, because it would reduce the problem of surface generation to the computation and shading of intersection points of rays with surfaces (section 1).

Claim 9, Ashton teaches discloses splitting of the successive splitting each object of the object of the physical 3D object scenes is performed (col. 11, lines 38-40).

Claims 10-17 and 19-28, Snyder teaches the splitting is terminated upon satisfying a user specified dimension criteria for either x or y dimension is a pixel subunit (sections 3.1.2, 3.3.1, page 125-126); splitting is performed in z dimension (section 3.3); find a first root; find all roots; a set of inversion is performed over a parametric domain to narrow unknown parametric variables; a box of the boxes representing selected areas. Snyder does not teaches find roots; however, Caprani et al. teaches finding a root of a function (sections 2-4); boxes representing the selected areas (section 4.1, page 18). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate ray intersection root taught by

Caprani into the method ray tracing of Ashton, because it would reduce the size of the isolated interval to any desired accuracy (section 3).

Claim 30, Ashton teaches a scene data base (3D data base; fig. 1); a processor for executing an interval analysis (fig. 6).

6. Claims 32-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder "Interval analysis For Computer Graphics", ACM 1992, pages 121-130 in view of Duff "Interval Arithmetic and Recursive Subdivision for Implicit Functions and Constructive Solid Geometry", ACM 1992, pages 131-138.

Claims 32 and 33, Snyder teaches a plurality of hierarchical interval consistency solvers for rigorous computation of a visible solution visible solution set of a nonlinear geometric function representing at least a portion of a pixel of the digital scene, and user defined shading routines mutually dependent upon solvers of said plurality of hierarchical interval consistency solvers, the visible solution set of the non-linear geometric function representing the at least a portion of the pixel of the digital scene being input to the user defined shading routines (section 1.1 and 1.2). Snyder teaches interval consistency solvers by recursively subdividing and does not teach hierarchical interval consistency solver; however, Duff teaches Constructive Solid Geometry tree (hierarchical interval; section 5).It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate CSG tree taught by Duff into the solver algorithm of Snyder, because using CSG combination s of implicit function primitives, it would allow users to focus attention on interesting or useful local features of implicit functions that may extend to infinity or otherwise behave wildly at a distance

(section 4); further, Snyder teaches series of geometric functions being sequentially operated upon by solvers of said plurality of interval consistency solvers (sections 1.1 and 1.2); resolving each parametric variable of parametric variables of each geometric function of geometric functions of said series of geometric functions for each iteration of said each geometric function of said geometric functions of said series of geometric functions (SOLVE algorithms, sections 1.1, 1.2 and 3.1).

Claim 34-50, Snyder teaches providing an interval consistency solver input comprising a series of geometric functions defining an element within the visual scene, each geometric function of geometric functions of said series of geometric functions having parametric variables; providing a plurality of interval consistency solvers; correspondingly resolving each parametric variable of said parametric variables of said each geometric function of said geometric functions of said series of geometric functions for each iteration of iterations of said each geometric function of said geometric functions of said series of geometric functions during processing of said interval consistency solver input by solvers of said plurality of interval consistency solvers (sections1.1, 1.2 and 3.1).

Allowable Subject Matter

7. Claim 31 is allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimbinh T. Nguyen whose telephone number is (571) 272-7644. The examiner can normally be reached on Monday to Thursday from 7:00 AM to 4:30 PM. The examiner can also be reached on alternate Friday from 7:00 AM to 3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi can be reached at (571) 272-7664. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

November 17, 2006

Kimbinh Nguyen

KIMBINH T. NGUYEN
PRIMARY EXAMINER